Comprehensive Underground Injection Control Program Evaluation: Missouri Department of Natural Resources

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Region VII, Water Division
Ground and Drinking Water Branch
Underground Injection Control Program

Contents

A. EXECUTIVE SUMMARY

The purpose of this report is to ensure that the state's Underground Injection Control (UIC) program is permitting and implementing the delegated authority in a manner that is protective of underground sources of drinking water (USDW) along with any other requirements set forth through primacy approval.

State regulations for the implementation of the UIC program are based upon the section of the Safe Drinking Water Act (SDWA) for which they apply and receive primacy. State programs delegated primacy under Section 1422 of the SDWA must demonstrate that their regulations are as stringent as the federal regulations. Programs delegated authority under Section 1425 of the SDWA must demonstrate that their regulations are as effective in protecting USDWs as the federal regulations; this authority is only applicable to Class II wells. The Missouri Department of Natural Resources (MDNR) UIC program operates Class I, III, IV and V wells under 1422, and Class II wells under 1425.

The review conducted by the Environmental Protection Agency – Region 7 (EPA) of Missouri's 1422 and 1425 program finds that the MDNR is operating the program effectively as per primacy approval. The review findings indicate that the program is as stringent or as effective in all areas of the delegated program. Though the findings show that the overall program implementation is commendable, there is still capacity for improvement. These areas of improvement include: communication both internally between programs, and externally to the public; ensuring public notice requirements are fulfilled; decreasing the use and construction of improved sinkholes; and establishing a plugging prioritization list while increasing the oil and gas remediation fund balance.

B. INTRODUCTION

In accordance with requirements for continuing environmental programs the EPA, utilizing the National Comprehensive UIC Program Evaluations document, conducted an on-site comprehensive review for both the 1422 and 1425 programs on December 11th and 12th, 2019. In Missouri the 1422 and 1425 programs are administered by several programs within MDNR and by other departments within the state through memorandums of understanding (MOU) and memorandums of agreement (MOA). The 1422 program is overseen by MDNR's: Division of Environmental Quality (DEQ) and Missouri Geological Survey (MGS) with the staff from Water Protection Program (WPP), the Environmental Remediation Program (ERP), and the Waste Management Program (WMP) located in Jefferson City, MO. The Department of Health and Senior Services (DHSS), located in Jefferson City, MO, through an MOU with MDNR oversees certain aspects within the 1422 program. MDNR's 1425 program is overseen by the MGS located in Rolla, MO. The program is authorized under the SDWA and operates under provisions for the Act and applicable federal and state regulations. All federal monies to operate and implement these programs are distributed to the DEQ and the MGS.

A comprehensive program review is a periodic, formal evaluation of an authorized program to determine if the delegated state is implementing their program(s) appropriately. Federal statutes require the EPA to know if non-federal partners are administering delegated programs in accordance with requirements. Although statutes do not specify the frequency of such reviews, the EPA has determined a review is warranted after evaluating the period of time since the last review and the extent of changes made to Missouri's regulations affecting the 1422 and 1425 programs.

This review was initiated in March of 2019 with the submission of two questionnaires which covered both the 1422 and 1425 programs. Responses from the questionnaires were received by the EPA on June 14th for the 1425 program and June 27th for the 1422 program. On August 17, 2019, through collaboration with the state,

the on-site comprehensive review date was scheduled to be held in Rolla on December 11, 2019 and conclude in Jefferson City on December 12, 2019. Follow-up questions based off MDNR's initial responses to the questionnaires were sent by the EPA on December 09, 2019. During the on-site review, the EPA Region 7 review team conducted informal interviews of MDNR staff and analyzed various files and permits pertaining to both programs with responses to the follow-up questions being recorded by EPA staff. These responses were sent to MDNR for review on January 10, 2020 and were received by the EPA on February 28, 2020. The draft MDNR program evaluation report was sent for review to MDNR on February 21, 2020 with final comments received by the EPA on May 12, 2020.

EPA's review focused on the entities within MDNR that implement and regulate the 1422 program (Class I, III, IV and V injection wells) and 1425 program (Class II injection wells) in Missouri. Through MOU's with various agencies within the state, listed in the appendix, the following entities regulate Classes I – V wells:

- Class I: This well class is banned in Missouri with enforcement of prohibition by the DEQ.
- Class II: MGS.
- Class III: WPP.
- Class IV: This well class is banned in Missouri with enforcement of prohibition by the DEQ.
- Class V: MGS, DEQ, DHSS and county health departments.

This report is structured from the program review questionnaire in addition to the informal interviews. Due to the intricacy of the delegated program within Missouri, this review surmises both the 1422 and 1425 programs.

C. CURRENT FINDINGS AND RECOMMENDATIONS

MDNR implements and operates a very strong delegated program. General communication and outreach to the public regarding the UIC program is conducted well. Communication internally across different entities that implement the UIC program is improving as was seen firsthand during the on-site evaluation and should be commended. With the current restructuring within MDNR, communication and cross collaboration should improve and has been made a priority. Interagency communication has been constant and has allowed for all parties to stay abreast on activities associated with the UIC program.

The MDNR and MGS website provides a great public source of information that is easily navigable. This includes: links to forms, current or proposed permits and actions, well inventory information, general state knowledge in relation to the UIC program, rules and regulations, and other relevant information. The oil and gas permit map database feature provides a good public resource on current and past permitted activities. Bi-annual inventory reports, posted online, on Class V wells is kept current but may need to be cleaned up to address duplicate and mislabeled files. Inventory data required by the EPA has been submitted on-time with data quality improving.

Public notice requirements for well activities and permits could be improved upon. While public notices are required to be posted in local newspapers, county clerks offices, on-site of the well and MDNR's website, nearby landowners still may not receive adequate notification. The state does not require any public notification regarding the intention to drill an injection well. Additionally, the state does not verify any public notification of nearby landowners from the permittee.

Due to the geology of Missouri, sinkholes are naturally prevalent and have historically, in certain areas of the state, been used as a means of disposal. These improved sinkholes allow for directed runoff or direct disposal

of anthropogenic waste to reach groundwater. While these wells are starting to be addressed, current regulations and enforcement should be improved. The WPP currently does not enforce permit requirements for this well type. EPA encourages that these wells continue to be addressed and investigated with any permit conditions be enforced to ensure the protection of any USDW.

Abandoned and orphaned wells are a common liability to many states and the public that utilize any proximal USDW. While Missouri is not an exception to this issue, the limited funding MDNR has access to address these wells could be improved. Currently, the state has under $10,000 in the oil and gas remediation fund to plug any abandoned or orphaned Class II wells. The initial lump sum that was deposited into the account upon creation has been depleted and proceeds, bond forfeitures, and investment returns have not been able to significantly replenish the account. EPA recommends that mechanisms be put into place that would allocate accessible funds in order to begin to start addressing this issue. Additionally, we recommend the creation of a plugging priority list to address wells that may have the potential to immediately degrade any USDW. Either of these recommendations could come first and would help address the other.

Finally, while not recommendations for improvement the following topic should be considered to alleviate potential future issues. Staff turnover and retirement is a common concern for most agencies and can result in a loss of institutional knowledge, which if not addressed can create problems implementing the delegated UIC program. Many states are currently developing plans to address this issue. We encourage the state to take a proactive approach to ensure systematic knowledge continuity and either begin developing in-house plans to address this or reach out to other agencies for support.

D. STATUTORY AUTHORITIES AND REGULATORY JURISDICTIONS

The Missouri Department of Natural Resources was first granted primacy for the 1425 portion (Class II wells) which became effective on December 2, 1983 (48 FR 54349). This was followed up with the approval on May 11, 1984 (49 FR 20138) of the 1422 portion of the program which covered all remaining well classes in the State of Missouri, except Class VI and those on Indian lands. The MGS has primary authority to regulate Class II oil and gas activities through statutory and rulemaking authority within Chapter 259, RSMo. Through MOU's, specific well types within each well class are administered by various agencies within the state. Communication is facilitated between the agencies through electronic communication, face-to-face meetings, and reporting of inventory information. Currently, the following MOU's are in place with some being updated or being considered for updates.

MDNR has the following in-state MOU's in place related to the UIC program:

- 2011 MOU Missouri Department of Natural Resources/Missouri Department of Health and Senior Services.
- 2019 Underground Injection Control (UIC) Permits at Remediation Sites.

E. ADMINISTRATION AND PROGRAM DEVELOPMENT

MDNR's 1,300+ staff are located throughout the state in six regional offices, including the Central Field Operations, and two project offices with the headquarters in Jefferson City. The Missouri Geological Survey is based in Rolla. Currently the organizational structure is being updated to better align people and programs. In total and at the time of this report the UIC program oversees 11,680 Class II and Class V wells.

Of the three types of Class II wells, only enhanced oil recovery and disposal wells are currently in use within Missouri. As defined within 10 CSR 50-1.030, an enhanced recovery injection well is an injection well used to move underground fluids to production wells through the use of water, steam, gas, or any other substance in order to redirect or facilitate the natural movement of oil, gas, or water in a pool. An injection well is a well into which fluids are injected during all or part of the life of the well for disposal or enhanced recovery projects or for underground storage of gas that is liquid at standard temperature and pressure, but not including oil- or gas-producing wells undergoing approved well stimulation treatment. Missouri regulates multiple types of Class V wells with the most common being septic systems, remediation wells, and sinkholes.

F. RESOURCES

With current Federal UIC funds, MDNR's 1422 and 1425 programs do not foresee any issues in meeting their current workplan goals. According to MDNR, funding levels are adequate to support inventory and reporting requirements.

The extent of training for new staff is dependent upon funding, however all new staff within each program will familiarize themselves with the various rules and regulations, local geology, and hydrology. If funding is available staff can attend regional and national UIC relevant trainings and conferences. Within the past year the MGS and ERP have been able to attend multiple Ground Water Protection Council (GWPC) meetings and other technical conferences, workshops, and trainings. Staff development is accomplished through these meetings and are supplemented with in-house staff development materials and documents.

G. WELL INVENTORY AND OPERATIONS

Well Class	Total Wells[1]
Class I	0
Class II Disposal	10
Class II Recovery	424
Class III	0
Class IV	0
Class V	11,246

Table 1 [1]MDNR Current Well Inventory as of 10/01/2019

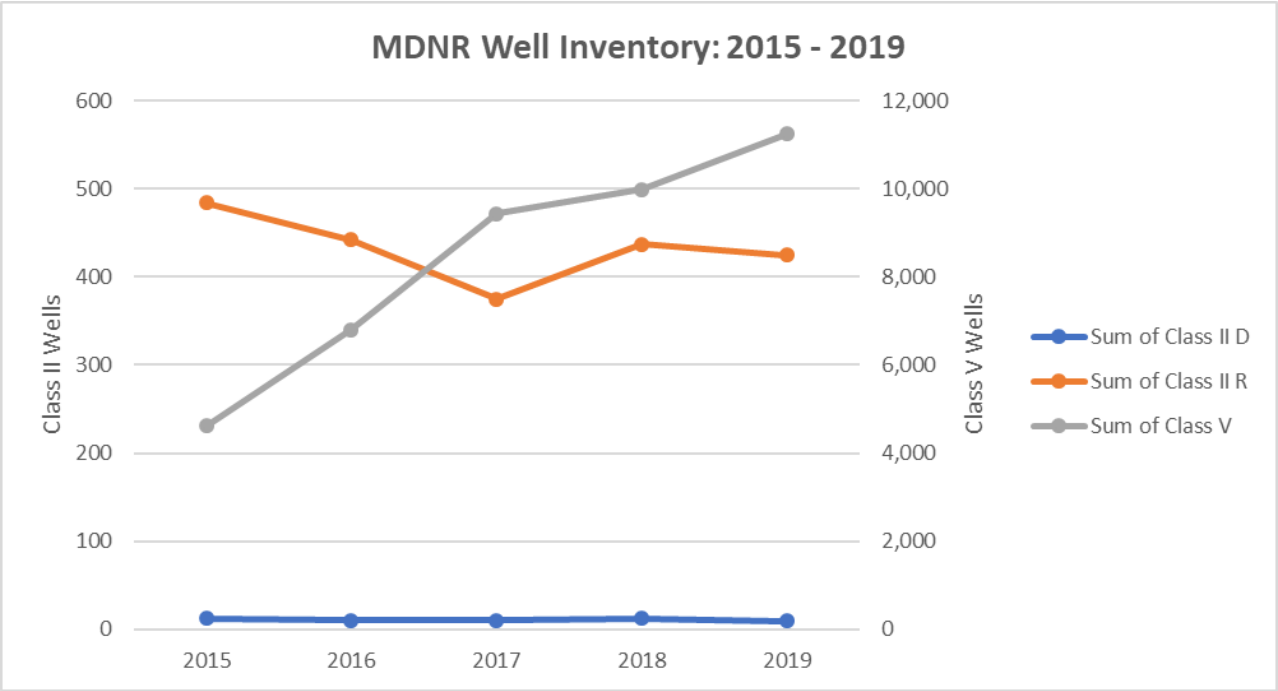

Figure 1. MDNR Well Inventory: 2015 – 2019

Class I Wells:

This well class is banned in Missouri, except in specified instances, by section 577.155, RSMO with enforcement of prohibition by MDNR's DEQ.

Class II Wells:

This well class is regulated by MGS through the State Oil and Gas Council. As of May 2019, there were 10 disposal wells (II D) and 424 enhanced oil recovery wells (II R) currently in inventory. As of December 31, 2018, there were 68 injection wells that were listed as abandoned. There is no distinction between Class II commercial vs non-commercial salt water disposal (SWD) wells. For all Class II salt water disposal wells, an analysis of the produced waters that are to be injected are required to be submitted. This analysis includes the fluid to be injected, the source of the fluid, and the compatibility of the fluid with the receiving stratum, and total dissolved solids comparisons. For Class II enhanced oil recovery (EOR) wells, the fluid to be injected must be compatible with that of the receiving formation and not be an undue risk to the subsurface environment. For injection wells the operator shall once a month monitor and record, during actual injection, the pressure or fluid level in the annulus and any other information deemed necessary by the state geologist. Annual reporting of injection activities is collected and is to be kept on record for five years.

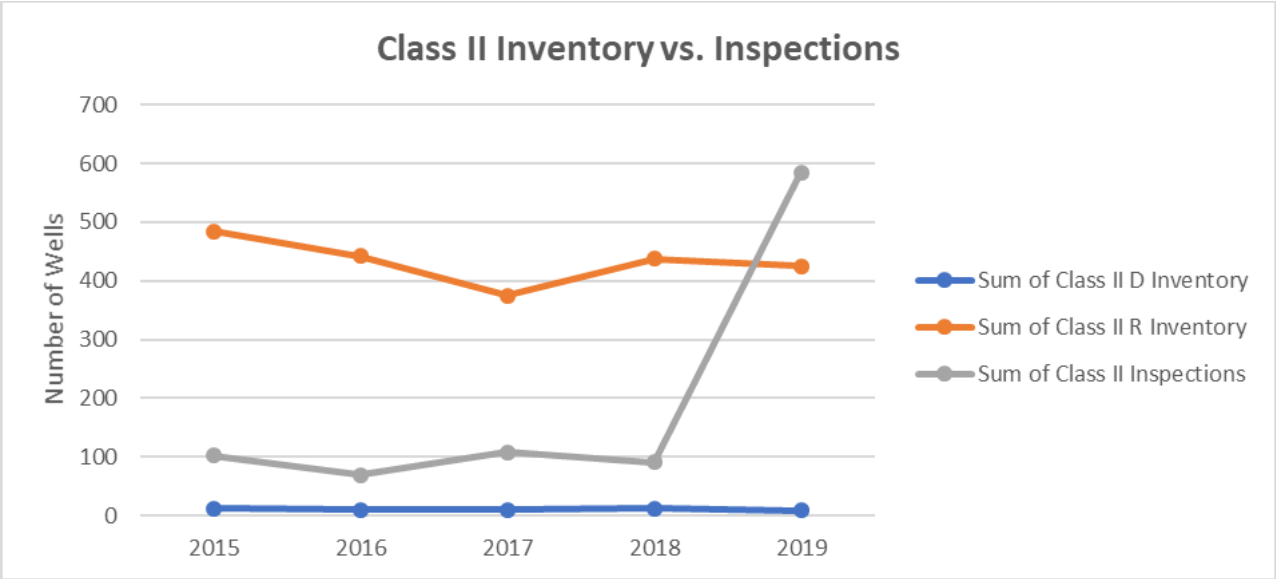

Figure 2. Class II Inventory vs. Inspections

Class II well violations, or violations that typically require enforcement, include: permitting or reporting violations, overdue mechanical integrity tests (MIT's), bonding issues, and abandoned wells. Within the last three years, there have been 41 enforcement violations, all of which were returned to compliance before their deadline and are summarized below. Within the last five years there have been no financial penalties issued nor are there any ongoing Class II well related enforcement actions.

Year	Well Type	Number of Wells	Violation	In Compliance
2017	EOR	26	Past due disposal reports	Yes
2015	EOR	1	Abandoned well	Yes
2015	EOR	12	Abandoned, not properly shut-in	Yes
2015	SWD	1	Abandoned, not properly shut-in	Yes
2015	SWD	1	Disposal well plug-back	Yes

Table 2. Class II Violations: 2015 – 2019

Class III Wells:

This well class is regulated through the Clean Water Commission and is administered by the WPP. While the state currently does not have any Class III injection wells, if an application were to be submitted then 10 CSR 20, Chapter 6 would apply unless specifically addressed elsewhere.

Class IV Wells:

This well class is banned in Missouri by section 577.155, RSMo with enforcement of prohibition by the DEQ.

Class V Wells:

This well class is regulated by the MGS, DEQ, DHSS and county health departments. Currently there are 8,077 active Class V wells in Missouri. The State has 636 wells inventoried and listed as temporarily abandoned (TA), 492 of which are abandoned water wells. A number of these water wells in TA status are a legacy from the early implementation of the UIC program that were inventoried as abandoned water wells which could have

been used for injection. Unless a complaint were received, investigation into these wells to ensure that they are not currently being used as injection wells does not occur. As per the Missouri Well Construction Rules, any well not in use for a period of two or more years and is in a state of disrepair must be plugged. MDNR administers and has in inventory the following Class V wells:

Well Type	Number[1]
Abandoned Water Well Used for Disposal of Waste	503
Aquifer Recharge Well	10
Automobile Service Station Disposal	42
Heat Pump/Air Conditioning Return Flow	257
Improved Sinkhole	1,003
Industrial Drainage Well	73
Mine Backfill Well	158
Septic System Drainfield Disposal Method (mostly regulated by DHSS)	4,710
Septic System Well Disposal Method	11
Storm Water Drainage Well	7
Subsurface Environmental Remediation	3,856

Table 3. [1]Current Class V Inventory as of 01/15/2020

If a reduction of resources were to occur, it would most likely affect the quality of inventory and reporting. Currently neither WPP or ERP are identifying and reporting on "high-risk" Class V wells. If any issues were to be found during inspections or permit review they would be addressed.

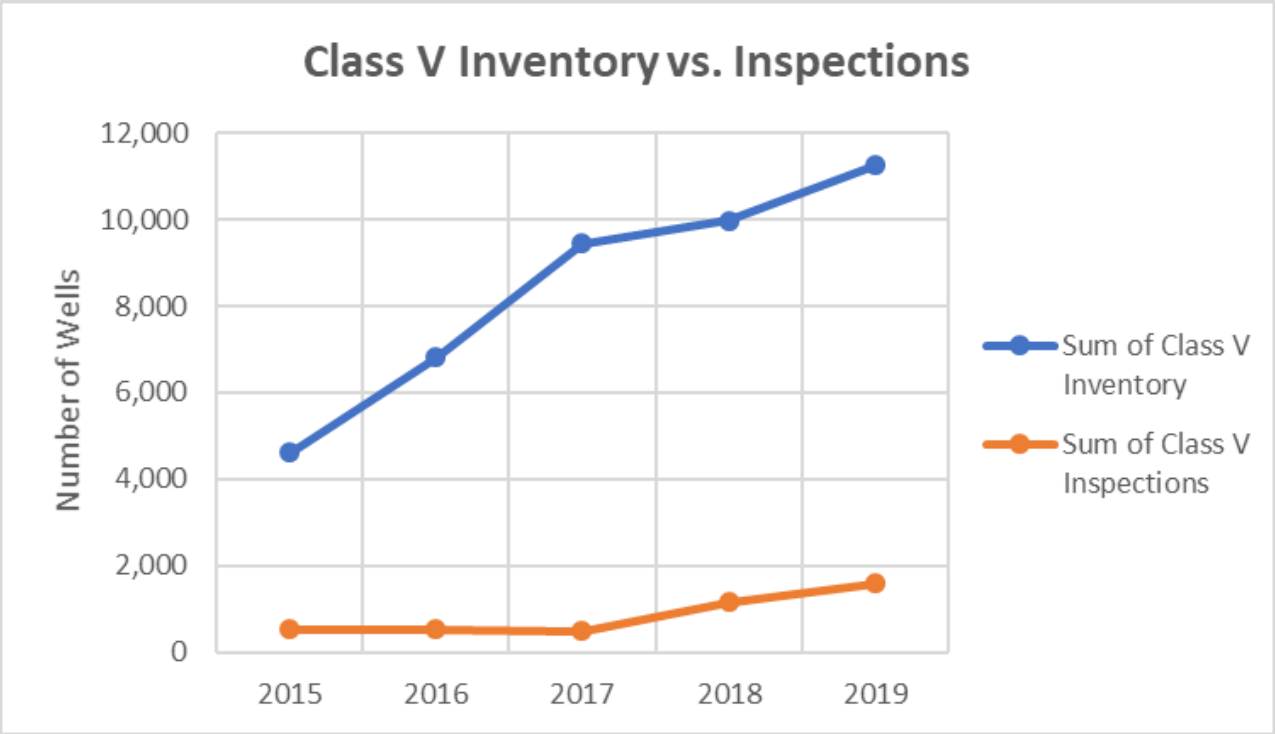

Figure 3. Class V Inventory vs. Inspections

WPP regulates large capacity septic systems with flows greater than 3,000 gallons per days (gpd) and for systems that inject industrial process wastewater. DHSS regulates domestic facilities with flows less than or

equal to 3,000 gpd. WPP provides inventory information to the MGS on a quarterly basis, while DHSS provides the information on a semi-annual basis. Due to local ordinances, smaller systems are not currently required to report inventory information, however the state is working on a solution to provide these systems with reasons as to why to report. Aquifer remediation wells are regulated only by construction standards but not by the materials being injected. For remediation projects, injection into an aquifer is permitted but there must be a plan for injected chemicals to be withdrawn or reduced to pre-injection levels. Mine backfill and mine stabilization projects are permitted by the WPP. Any fill material must have a beneficial use authorized through WMP; as the materials used typically must solidify to be considered beneficial, monitoring will typically end upon the completion of the stabilization project. If any waste water treatment facility wanted to dispose of fluids other than sanitary wastes, MDNR would work with them through either a permit or alternate route such as land application, National Pollutant Discharge Elimination System (NPDES), trucking, etc.

Class VI Wells:

Missouri does not yet have primacy for this well class.

Permitting:

Permit timeliness for issuance is dependent upon permit type, completeness of the application, complexity, and other site-specific criteria. Typically, within the WPP general permits are issued within 60 days, or 180 days for site-specific applications. Remediation well permits are approved at a minimum of two weeks, and DHSS permit issuance is dependent on the type of system and other possible variances. Staff from the MGS's Well Installation Section oversees regulations for Class II injection wells and has 15 days to review Class II well applications upon receiving a complete application as determined by the state geologist pursuant to 10 CSR 50-2.030(6). Class II wells may apply for both individual and area permits so long as the area permit well depths are ≤ 1,500 feet, with sufficient bonding in place for all wells. Applications for an area or blanket permit must include a plat map showing the unit boundaries, locations and symbols of all existing and proposed wells, and their identification numbers. A completion or recompletion report must be submitted within 120 days after the spud date of each well. If upon review of a permit during the 15-day review process the state geologist determines that the drilling of a well or the injection of fluids at the proposed site would cause an undue risk to the surface or subsurface environment, risks will be discussed with the permittee. If no amendments are offered or the undue risk still exists, the permit will be denied. If permits are determined to be incomplete the operator is notified, and the application is suspended. The operator must submit the missing information within 30 days and then the 15-day review period will begin anew. However, if the information has not been submitted within 30 days the operator is notified and the application is considered null and void and the operator must submit a new application. Upon permit approval an email along with the approved permit will be sent to the applicant. If the permit has been denied, the aforementioned process will occur along with the reasons for denial. The owner or operator may appeal any adverse decisions to the State Oil and Gas Council.

For Class II wells, if an owner or operator wants to amend an existing permit the process is treated as if the amendment was a new permit. Minor and major modifications are differentiated within the agency with minor modifications not needing to resubmit the permit application.

Recordkeeping requirements are established in each permit. UIC permits may be transferred with the application required to be submitted within 30 days of the transfer of ownership or responsibility. All well records are required to be kept on file for a period of five years by the operator unless specified as a permit condition. Certain records asked for or required by MDNR stay in house until the well(s) become(s) inactive. Records held by MDNR will be archived once inactive. Any important records should be on file with MDNR as required by regulations and or permit conditions. Regulations require that operators retain files for five years, however after five years regulations become vague, and permit conditions do not specify what operators may do with the files once this time has elapsed.

Area of Review:

Within the WPP the area of review (AoR) is based on the site characteristics and geology, injection rates and injectate, and proximity to USDW's and waters of the state. The MGS is consulted for site specific questions and other relevant information. The AoR for remediation wells permitted by the ERP is determined by the extent of expected impact for each injection location. Within the DHSS, a fixed AoR of 100 feet is used for private wells and heat-pumps, and 300 feet is used for public wells with wastewater permits having similar standards. Corrective action for wells deficient in the AoR is handled on a case-by-case basis.

For Class II wells a fixed radius AoR of one-half mile is used for single wells. For area permits, the AoR is determined using a one-half mile radius from the unit boundaries containing the area permit. Fluid disposal wells must be located a minimum of 165 feet from a unit boundary. No EOR wells including but not limited to those used for production or injection, drilled within a production unit shall be drilled nearer than 165 feet from the production unit boundary. Stratigraphic test wells are exempt from this requirement.

The geologic setting for on-site systems is determined by the site geology, geohydrologic evaluations, site characteristics and features, injection rate and material, and the proximity to USDW's. If needed, each program will consult another program to ensure an accurate geologic setting determination. Site visits before permit determination are not conducted unless it is a unique situation. A unique situation could include any of the following: unique well construction, drilling in a sensitive location, applicant has prior violations, or the applicant is a new operator.

Corrective action for wells is conducted on a case-by-case basis. Wells in need of corrective action, but outside of the permit applicants' control, may be handled through permit conditions, permit denial, or plugging of the well.

Well Construction and USDW Protection:

Chapter 644, RSMo, prohibits any person from causing pollution to any waters of the state, which includes groundwater. While not specifically groundwater protection areas, Missouri's Water Well Construction Code sets water well construction standards for specific areas within Missouri based upon geologic, hydrologic, and/or environmental standards. In order to protect USDW's, Missouri uses and maintains total dissolved solids (TDS) concentration maps to determine the vertical and horizontal extent and the lowermost depths of USDWs within the state. For new Class II permits or modification requests, well construction, schematic, and lithologic log information is submitted to MDNR for review against the TDS map along with other geologic and hydrologic resources to ensure USDW integrity. Specific well construction requirements include casing being set through all unconsolidated material plus 20 feet into the underlying bedrock, and in areas with a USDW casing must be set 50 feet below the base of the deepest USDW penetrated. Wells being converted from production to injection must meet certain construction requirements outlined within the state regulations with the state geologist having the ability to require specific casing and cementing requirements.

Well Completion:

Upon completion of the well, Class II wells must submit the oil and gas well completion or recompletion report and well log to MDNR within 120 days after the spud date or recompletion. The operator may request up to a 60-day extension. Applications to drill, deepen, plug-back, or recomplete a well must be submitted to the agency before the operator may begin implementing any of the proposed changes. These well completion activities are rarely witnessed by MDNR staff.

Public Participation and Outreach:

Public notice requirements are based on permit type within each agency. Water permits within WPP require a 30-day public notice period. Area or general permits within the agency will be public noticed as a group, unless the site cannot meet the general permitting requirements. Within the ERP, if UIC is part of the remediation plan then a public comment period is required. Response to public comments or at public meetings within the WPP are addressed to each commenter. For remediation projects, the project manager works directly with stakeholders to address any concerns. Dependent upon the program, final decision notices are available online and/or transmitted through notices in the newspaper or by direct written notice. On average, and dependent upon the nature and number of comments, responses to comments received during the public participation portion are typically provided within 90 days but can vary between 30 and 180 days.

Class II injections wells are not required to provide a public notice of the intention to drill. However, the injection permit applicant must provide certain notice of the intent to operate an injection well. Landowners who are within a one-half mile radius of any Class II well undergoing mechanical integrity testing or a well stimulation treatment must be notified. Class II wells typically receive no public comments. The permit application and public notice can be submitted at the same time. If anything in the public notice is incorrect or has changed from the approved notice, the applicant must resubmit the public notice. All requirements of the public notice are verified by MDNR and the application is filled out by the applicant. MDNR does not verify that nearby property owners receive notice. A public hearing could be held dependent upon if the application involved a unique situation, its operations were related to drinking water protections, there was merit to comments, or if a widespread public interest was present. However, ultimately MDNR makes the final decision on whether to hold a public hearing.

Injection Pressures and Confinement:

DEQ does not determine fracture pressure for Class V wells unless the well were considered deep, in which DEQ would consult with the MGS and water program; however, there has not been a well deeper than 200 feet drilled within the last 10 years. The maximum operating pressure for wells within the ERP and WPP is determined by flow rates, site specific conditions, and reviews from the MGS. Class II wells have set limitations for maximum injection volume, pressure, and injection rate with fluids not allowed to migrate or be displaced into any USDW. If there is no general or historical information on local injection pressures, applicants can inject at 0.75 psig/ft to the middle point of the perforated interval. Different types of injectate will have different allowable rates. If an applicant were to request a higher injection rate, then a step-rate test would be used to determine maximum injection pressure. Seismic shot holes are not allowed to initiate new fractures or propagate existing fractures in the confining strata or USDWs. Maximum injection pressure is approved by the state geologist and is based on the state of matter being injected and must include data to prove the requested injection interval can tolerate the requested pressures and volumes. Produced fluids from oil and gas operations that are to be injected, must be disposed of into their original zone of production, otherwise are banned from being injected into any other formation or USDW without an exemption approved by the state geologist.

The competency of the confining zone(s) surrounding an injection zone is determined by conducting a hydrogeologic site characterization by following a state guidance document. The state recommends an in-situ conductivity test to determine the permeability of the expected confining zone. These reports are submitted to the program and are assessed by geologists to determine completeness. Most remediation sites do not affect a USDW but if there were a potential affect then the MGS would be contacted for guidance.

Within the ERP there have only been two reports of over-pressurization, both in 2010, where injected fluids resurfaced. In both instances' injection was immediately stopped with site evaluation still ongoing. To date

the staff of the MGS are not aware of any problems associated to over-pressurization of Class II wells or formations due to injection activities.

Injectate is regulated to ensure pollutants of concern do not impact waters of the state. Monitoring of groundwater to ensure protection can be required when deemed appropriate. Remediation injection projects must reference research or tests to prove that the injectate will remediate the contaminants of concern. "Land-spreading" of solid waste generated by drilling operations is permitted, except when the waste would pose a risk to human health and/or the environment due to the presence of contaminants.

H. FINANCIAL ASSURANCE

In Missouri there are no specific financial responsibility requirements for Class I and V wells. Regulations for Class III wells, if ever drilled, do require the applicant to prove financial ability. Performance bonds or letters of credit are only conditionally required for well or pump installation contractors who have had a permit revoked or were found guilty of a Class A misdemeanor. Additionally, some sites under the Federal Facilities Section are required to obtain financial insurance along with operators who wish to post a bond in lieu of time as required by the apprenticeship program. For these federal facilities or any facility listed on the National Priority List, the EPA is named as the "Payee" as opposed to the State of Missouri. The state, however, is the payee for mechanisms listed under Section 256.616, RSMo, and 10 CSR 23-1.050. Since 2000, there have been no instances within the 1422 program where the financial guarantees posted by the owner or operator were insufficient for well plugging. Financial assurance for Class II wells is required and can be in the form of a certificate of deposit, surety bond, or letter of credit. Each instrument has its own specific conditions of assurance. Bonding schedule amounts are determined by the State Oil and Gas Council for both single and blanket bonds by depth of the well or depth and number of wells. Wells over 1,500 feet deep must be bonded individually. An annual financial assurance audit is performed to confirm that all instruments are active. Bonds and associated financial assurance instruments must be in place before drilling or modification of a well or injection, transfer, or replacement of a bond. Upon closure of a well operators are not required to adjust their bonding cost figures based on plugging and abandonment cost estimates. In case of a default on any financial assurance instrument, the State of Missouri is named as the payee. If the financial guarantees posted by the owner or operator were insufficient then funds would be pulled, if available, from the oil and gas remediation fund to cover any additional plugging and abandonment costs. This fund was originally funded by the state for emergency services through one lump sum and has not been replenished by the state and is filled through bond forfeitures.

I. WELL CONVERSIONS

Class II wells converting to a non-injection well must submit an oil and gas permit application to drill, deepen, plug-back, or recomplete and be in compliance with 10 CSR 50. For well conversion to an injection well the applicant must comply with 10 CSR 50 and 10 CSR 50-2.055. Financial responsibility assurance is required before any conversion can occur. Within the state there are few Class II conversions.

J. DRILLING FLUIDS/MUDS

Currently, within the state the major drilling mud fluid is a bentonite plus gel mixed with fresh water. Shallower wells may only require air rotary methods without the use of a mud fluid. Specific additives within the drilling fluids include: Aquagel, caustic soda, soda ash, PacR, Carbonox, Quebracho, EZ Mud, Ball Buster,

ConDet, Soap Stix, X-Trend II, BiCarb, lignite, Tannithin, Drispac, Nut Plug, drilling paper, Multi Seal, Poly Plus, cotton seed hulls, flake, cedar fibers, mica, nut shells, and lime. Fluids and their chemical constituents that are used for these activities are not required to be posted on FracFocus.

K. WASTE DISPOSAL

Within the State of Missouri, the estimated total volume of brine production in 2018 was 1,406,883 barrels (bbls) with an average water to oil ratio of 15:1 bbls. Reuse and recycle practices of the waste is not encouraged by MDNR and no known operator reuses and or recycles their drilling wastes. Of the waste produced, flare gas from Class II wells is not regulated nor has a known quantity of emissions. Within the state, MDNR is not aware of any local ordinances that apply to exploration and production wastes or any regulatory provisions that segregate these wastes from hazardous waste.

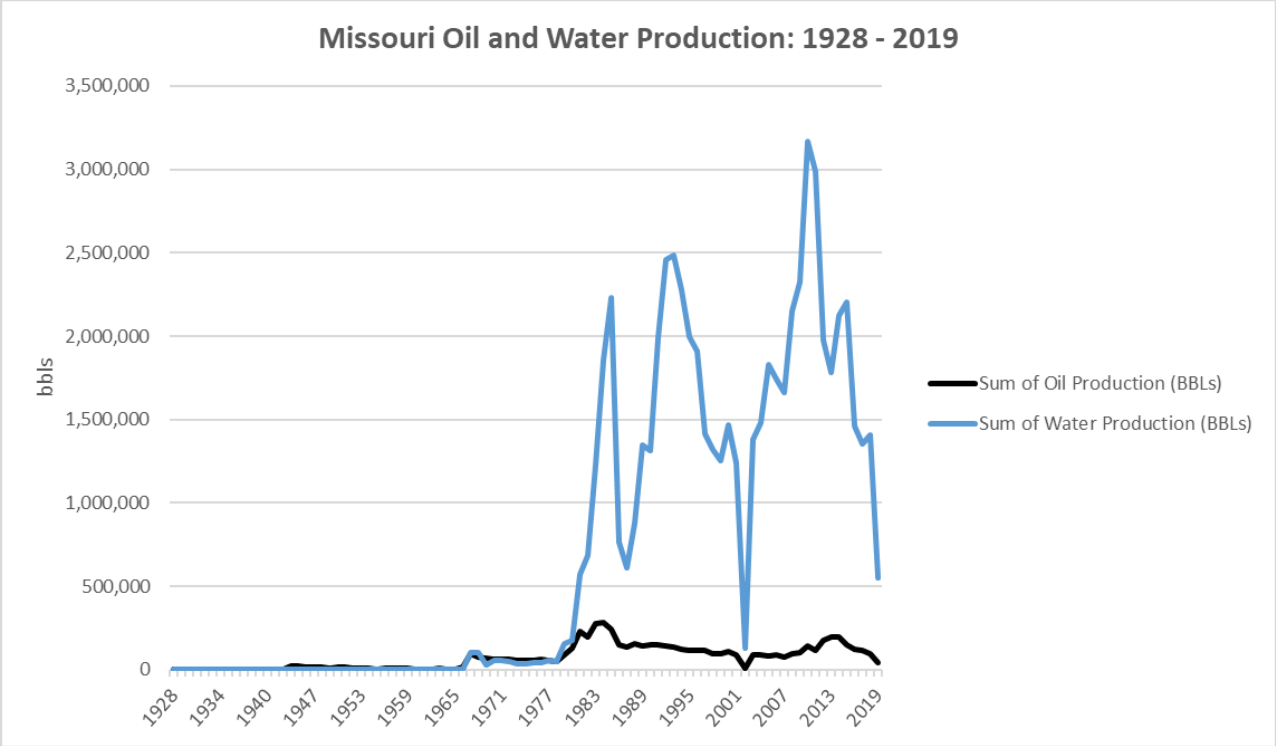

Figure 4. Missouri Oil and Water Production: 1928 – 2019

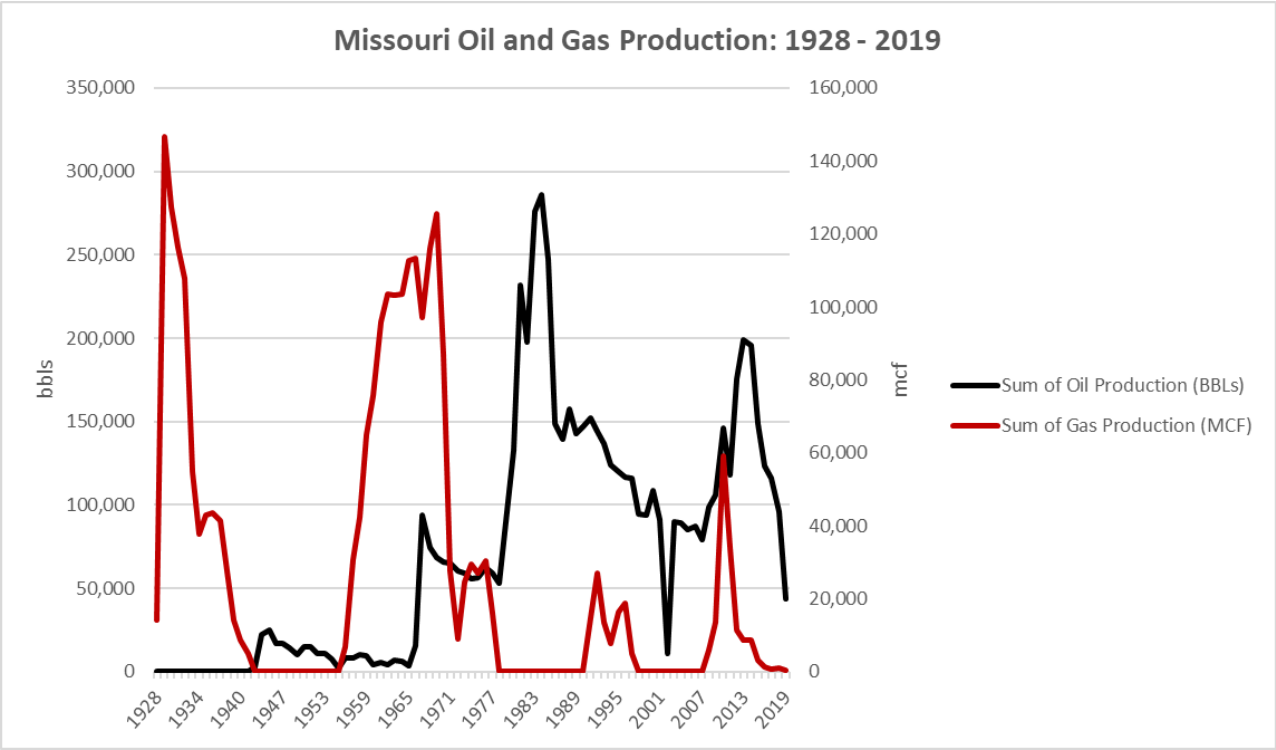

Figure 5. Missouri Oil and Gas Production: 1928 – 2019

L. WELL WORK-OVERS

Class II well workovers are treated the same as a new well permit and requires an operator license, bond, and financial assurance approvals. A well recompletion report must be filed within 120 days after completion. Workovers must be reviewed and approved before commencement and thus have no advanced notification requirements. Estimated volumes of workover fluids and deck drainage, and how these fluids are disposed of are unknown to MDNR. Since 2012, or the past seven years, there have been no known well-workovers within the state.

M. WELL STIMULATION AND HYDRAULIC FRACTURING ACTIVITIES

Class II well stimulation projects require a five-day notification to the state before commencing. Within 30 days after completion the operator must submit the treatment tickets along with what materials were injected. Prior to 2016, well stimulation activities were not required to be reported; however, none have been reported since 2016. Within the state there has been minimal public interest or concern regarding hydraulic fracturing. Fluids and their chemical constituents that are used for these activities are not required to be posted on FracFocus.

N. TEMPORARILY OR PERMANENTLY ABANDONED WELLS

The MGS recognizes a temporarily abandoned well as any well that is inactive from its first day of inactivity up to day 90 of continuous inactivity. Once the well has been continuously inactive for 90 days it is required

to perform one of three shut-in options, which include returning the well to operating status, plugging the well, or file for a one-year extension of inactivity. These extensions, if consecutive, shall not exceed ten years. Once the extension is reached, or after 10 years of consecutive extensions, and the well is still shut-in, the well will be deemed abandoned and the operator shall plug the well. An abandoned well within the state is any well that is no longer operated for its intended use and has not been shut-in, converted to another type of well, or plugged. Upon receiving a verbal or written statement from the owner or operator that the well has been plugged, staff may confirm the status of the well through a field visit. The state does conduct investigations into abandoned Class II wells through file review, online searching, and reaching out by contacting known and associated individuals. As of December 31, 2018, there were 68 injection wells that were listed as abandoned. Only two of the 68 wells were confirmed as abandoned in 2018, as the other 66 could not be confirmed. Within the state there are no known Class V temporarily abandoned wells, however there are less than 4,816 well types that are in some state of abandonment. To obtain an abandoned classification the well must have been: plugged and verified, never drilled, will be verified as existing and abandoned, or will be orphaned or lost to where the existence cannot be verified. Since 2017, there have been no wells funded to be plugged by the oil and gas remedial fund.

O. PLUGGING AND ABANDONMENT

Certain Class V WPP wells require the submission of a closure plan for the well upon cessation of activities. These plans are reviewed by regional office staff before plugging can occur, and upon closure the permit is terminated. Wells regulated by Sections 256.600-256.640, RSMo, are required to be plugged when not in use for two years or more and are in a state of disrepair.

Class II wells generally require the submission of a plugging plan and must notify the state geologist no later than five days before the plugging. Exceptions to this notification requirement can include emergency situations or to avoid rig downtime which both require oral notifications. The operator, in lieu of prior notice or approval to plug, may elect to plug the well from a total depth to surface following requirements in the regulations. Once a well has been plugged a plugging record must be submitted to the state geologist within 30 days after completion. MGS staff may conduct site visits to confirm that a well has been plugged and in some cases before the bond is released. In the case of abandoned wells, testimonials may be used to document that a well has been plugged if no responsible party can be found. Older wells that were abandoned prior to the existence of Missouri's Oil & Gas laws are rarely rectified with no exercise of authority taken by the state. Missouri's Oil & Gas laws along with state regulations can issue orders for responsible parties that can be found to plug abandoned wells, and if no responsible party can be found will be paid for by the oil and gas remedial fund. This fund is supported by all proceeds derived from the sale of illegal oil and gas and bond forfeitures but does not include a plugging prioritization policy. The oil and gas remedial fund primarily contains the only funds available to plug wells, unless the well(s) were to pose a significant risk or were associated with hazardous waste in which case another fund may be available.

Post-closure monitoring for Class V wells is determined by site and project-specific conditions. Additionally, all wells are required to comply with well plugging standards of the state. Class V wells under standard conditions part 1 site specifics require closure plans to no longer be out of permit requirements.

P. SEISMICITY

Within the state there has been minimal interest from the public concerning hydraulic fracturing. The only specific policies regulating induced seismicity comes from the initial permit or workover to where if the state

geologist determines that a drilling or injection of, or at a well, would be an undue risk to the surface or subsurface environment the permit will be denied. Within the region induced seismicity has been typically associated with deep, sub 3,000 feet, injection wells. Within Missouri the maximum injection interval is around 2,400 feet and has not been associated with any induced seismicity within the state. There are no known injection wells that inject into or have drilled through the Precambrian basement rock. The state does not require the owner or operator to conduct a comprehensive review of the area to determine faults within the AoR, nor does it require a complete suite of geophysical logs to be run on newly drilled injection wells. Additionally, the state does not require a geophysical survey, measurement or calculation of original downhole reservoir pressure, or step-rate tests to be conducted prior to injection. The state geologist may deny any permit they believe will cause an undue risk to the surface or subsurface environment and will set a maximum injection pressure for injection wells. Once the maximum injection pressure is determined, the state does not require the installation of a continuous pressure monitoring or data recording system, nor an automatic shut-off system if the injection pressure exceeds the permitted maximum level.

Q. WELL MECHANICAL INTEGRITY

Class V wells within the ERP and WMP must demonstrate that they function as intended for the remediation of contaminants and efficacy. Problems with Class V wells are initially handled by the owner or operator then escalated to ERP and WMP with the WPP and/or MGS handling enforcement. Failure of containment must be immediately communicated to the 24-hour Environmental Emergency Response Hotline, operated by the Environmental Services Program.

Mechanical integrity testing for Class II wells are tracked through bi-annual reports using the MGS's UIC oil and gas database; Class V wells are not tracked. Enforcement of 5-year MITs for Class II wells are accomplished through compliance assistance, letters of warning, notices of violation, and administrative orders. Late fees, penalties, and bond forfeiture are permissible through Chapter 259, RSMo and 10 CSR 50.

Notification of any injection well not able to maintain mechanical integrity, or if conditions develop that threaten the quality of surface or groundwater, must be made to the state geologist within 24 hours and the operator must cease operations. This initial notification must include the details of the problem and propose a corrective action plan in writing within five business days. The operator has no more than 60 calendar days to restore mechanical integrity (MI) or must plug the well. Whenever it appears to the state geologist that any water from any well is migrating or infiltrating into oil-bearing or gas-bearing strata or that any detrimental substances are infiltrating any underground sources of drinking water, the state geologist may require a shut-off test. For abandoned oil or gas wells to where these circumstances apply shall immediately plug or repair the well.

R. COMPLIANCE, INSPECTIONS, AND ENFORCEMENT

Compliance:

Compliance assistance to the public and regulated community is conducted by all programs including DHSS. These visits help the public understand how to best comply with the terms and conditions of a permit and demonstrate how to operate a facility or conduct an activity in order to guarantee compliance. WPP helps facilitate certain technical Class V well compliance requirements to the public by consulting with the MGS. ERP and WMP sometimes educates the public during site visits or inspections and may additionally, hold outreach events or stakeholder meetings for specific injection projects.

Class II compliance assistance is conducted through outreach and presentations at meetings or through mailings or webinars. Notices are sent out as reminders for upcoming MITs, extended shut-in renewals, annual license and bonding reports, and for monthly reports past due.

Inspections:

Class V well compliance inspections are conducted periodically or as needed to determine compliance through WPP and ERP; DHSS does not conduct any field activities not associated with the permitting process. During these field inspections, samples may be collected to determine compliance or in some instances to evaluate migration of fluid. While there is no Quality Assurance/Quality Control (QA/QC) plan in place, MDNR operates under its Quality Management Plan (QMP) for sample data collection. This plan requires that any subgrantees, contractors, or potentially the regulated community who generate environmental data to develop Quality Assurance Project Plans (QAPPs) or other quality management tools. These QAPPs for ERP and WMP are updated at least every five years. Class V inspections conducted within the WPP are periodic and are solely focused on compliance with the Missouri State Operating Permit (MSOP) and the Missouri Clean Water Law and its implementing regulations. Water Pollution Control Branch (WPCB) inspectors are not versed in the Safe Drinking Water Act and are not expected to evaluate compliance with UIC regulations. WPCB inspectors are trained to evaluate compliance with the MSOP conditions and the Missouri Clean Water Law and its implementing regulations. Neither ERP nor WMP conduct Class V inspections, however site visits are made to verify characterization and remediation work and to provide on-site technical and regulatory guidance.

Inspections for Class II wells evaluate several elements during the inspection with the inspector having the authority to sample fluids at any time during injection operations. These inspections are entered into MGS's UIC oil and gas database system application. When sampling is conducted, SOP's from environmental services are used. Five-year MIT compliance is tracked through the oil and gas database.

As of May 17th, 2019, of FFY 2019, the following number of wells have been visited or inspected:

- MGS: 530 Class V wells;
- ERP: Six sites which contained a total of 630 injection wells, points, and trenches; and
- WMP: 0 wells inspected.

MDNR currently can fund or has available the following positions for inspections:

- MGS: 0.5 FTE geologist to assist with 1422 program inspections; five geologists to assist in geologic and hydrologic site characterization; four field inspectors, which consist of geologists, environmental scientists and technical assistants to perform well construction and plugging compliance investigations.
- WPP: One, maybe more, inspector(s) per region available to assist in UIC inspections or issues.
- ERP: 52 positions within ERP and WMP that may assist with inspections in an advisory role.

Enforcement:

Enforcement is handled differently within each program, but typically violations are escalated from letters of warning, to notices of violation (NOV), to administrative orders, and finally to penalty demand letters.

Within the WPP, regional staff outline the actions needed to resolve the violations and provide technical and compliance assistance if requested. If these efforts do not resolve the violation, the matter is escalated to formal enforcement action. For this to occur, WPP must demonstrate that the violations represent significant non-compliance prior to taking formal enforcement action against an entity. The process goes through the aforementioned escalation process, but in rare cases unilateral orders are issued where negotiations do not

occur. If violations are not resolved, then staff refer the case to the State Attorney General's Office for resolution.

While there have not been any Class V enforcement actions taken recently, systems with likely enforcement violations would involve large capacity soil absorption systems servicing 20 or more people that have domestic wastewater treatment design capacities of 3,000 gpd or more. Additional violations might include failing to submit required permit reports, failing to renew a permit, and discharging or operating without a permit. The WPP, with consultation from the MGS, utilizes the definition associated with the UIC program to determine significant non-compliance.

The primary enforcement method within the MGS for Class II wells is compliance assistance, which has a success rate of ~50% of violations returning to compliance. This is typically used for violations that do not pose an immediate threat and are conducted through less-formal documented phone calls or written requests. If compliance assistance fails, or the violation is from a repeat offender, a letter of warning is sent. This letter includes the violation, how to return to compliance and sets a deadline to do so, which is typically 30 days. When a violation poses a moderate threat, or the letter or warning fails, a notice of violation is issued. This notice includes everything from the letter of warning but adds in a penalty for not returning to compliance of $1,000 per violation per day. The final escalation of a violation is to an administrative order and assessment of penalties being issued. This action is sent for when NOV's fail, or if the violation poses an imminent health or environmental threat. The order includes everything from an NOV and adds that if the operator does not return to compliance their bonds may be forfeited and the enforcement case may be referred to the Attorney General's Office for further enforcement action. Appeals can be made to the Oil and Gas Council within 30 days for any order or denial of a permit, license, or transfer issued by the state geologist.

MDNR reported zero significant noncompliance (SNC) violations in 2019 and five SNC violations in 2018. SNC violations are violations that endanger or pose a significant potential to endanger underground sources of drinking water and the violations are not addressed with formal enforcement action or returned to compliance within 180 days of identification.

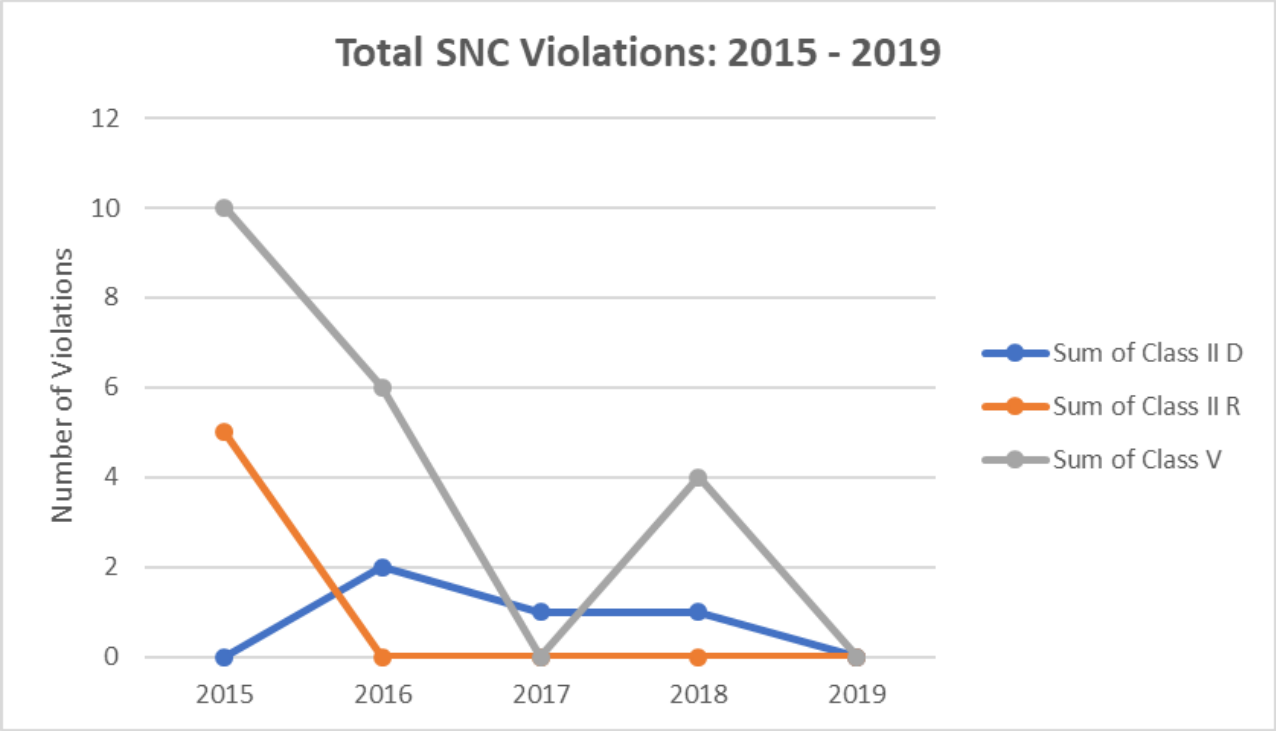

Figure 6. Total SNC Violations: 2015 – 2019

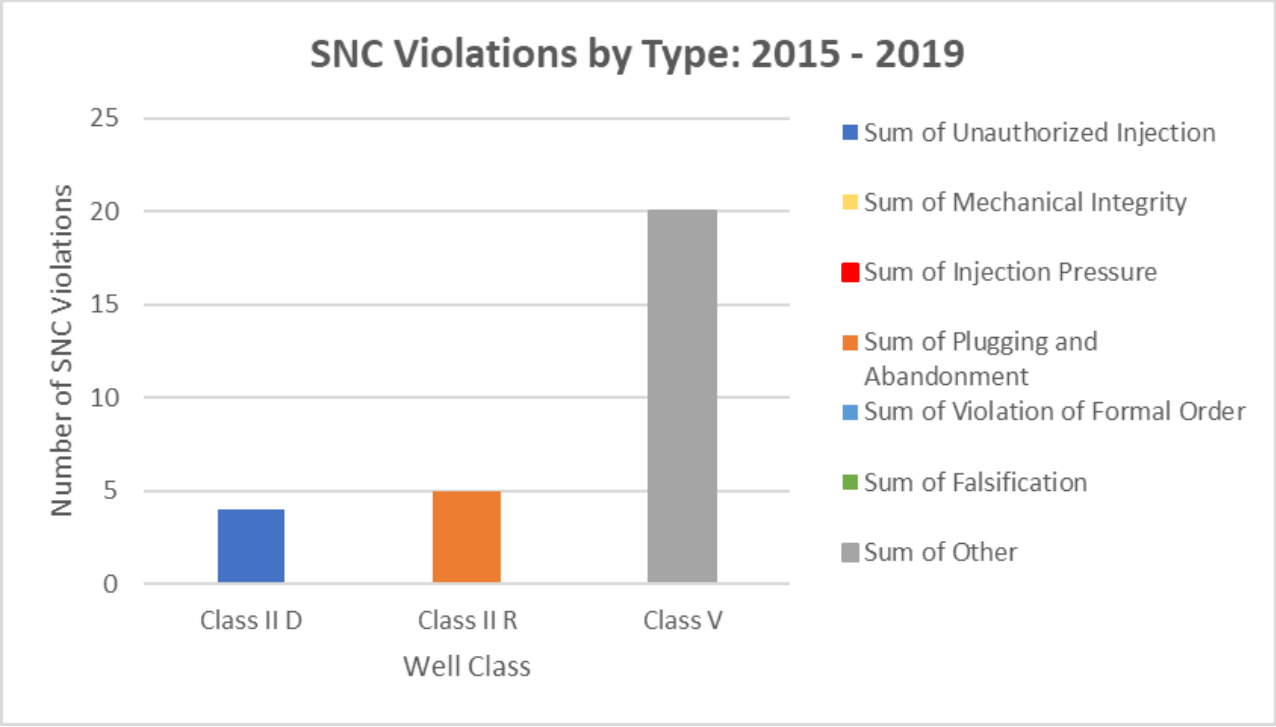

Figure 7. SNC Violations by Type: 2015 – 2019

S. REPORTING

Class II well operators are required to submit both monthly and annual reports. Monthly reports must include the current status of each open well, well production, and specific disposal information for all fluids produced. These monthly reports may be waived if the production is solely used by the owner and is not commercially sold. Annual reports are due January 31, and must include an annual injection well monitoring report, a complete inventory report, and an annual financial assurance report. The financial assurance report must be signed and notarized ensuring all open wells have sufficient financial assurance. The inventory of all other well classes is required to be reported annually.

T. ELECTRONIC DATA SYSTEMS

The MGS utilizes an internal UIC oil and gas database application which tracks: company, contact, facility, permit, well, inspection, violation, and enforcement information. This information is entered and updated by a select number of staff within the MGS and is typically added within a week of being provided. Through this database, inventory information is uploaded and used for federal reporting requirements while also being published on a semi-annual basis made available to the public. While a backlog of information still exists, there has been significant progress in reducing the number of records not within the database. The current challenge is determining the status of older wells with typically incomplete information. Database updates and maintenance challenges currently include updating and recoding the database to meet state needs.

U. COMMUNICATION AND COORDINATION

DEQ and MGS have regular communication with EPA Region 7 through email, phone, and typically through multiple meetings and conferences held throughout the year. MGS currently holds one elected position on EPA's National Technical Workgroup (NTW) and provides the group with valuable information and responses to questions. Communication and discussion with other states both regionally and nationally occurs regularly during these meetings, calls and conferences.

Within Missouri, the agencies communicate with periodic and annual face-to-face meetings, emails, and phone calls to discuss UIC issues, updates, and requests for information. Communication has begun across the state over UIC topics along with data acquisition and management. The ongoing realignment within MDNR will help foster and increase this communication. MGS recently coordinated a UIC program meeting with MDNR programs and DHSS staff to review roles and responsibilities. Permits through WPP are coordinated with MGS prior to issuance, and Class V permits submitted through DHSS are communicated to MDNR through their MOU. Through public outreach the state provides information and assistance to the pubic in the forms of training and various technical and non-technical UIC related guidance. Within the past year the MGS presented an overview of the UIC program and inventory requirements at a conference to a diverse audience. The MGS additionally assists the public in understanding rules and regulations along with whom to contact for various types of injection wells. Upon request, ERP and WMP project managers will provide regulatory and technical guidance to stakeholders to complete conceptual site models and UIC work plans.

V. APPENDIX

MDNR Rules and Regulations
MDNR MOU/MOA Documents
MDNR 2018 UIC White Paper
MDNR Quality Management Plan
MDNR MGS Guidance Document
MDNR Acronyms and Definitions
MDNR 1422 Program Evaluation Questionnaire Responses
MDNR 1425 Program Evaluation Questionnaire Responses
MDNR On-Site Reviewed Application and Inspection Examples
MDNR Program Evaluation On-Site Review Response to EPA
MDNR Comment Letter on EPA Review of UIC Program Comprehensive Review
MDNR Additional Correspondence and Response
MDNR Organizational Structure
MDNR Forms
MDNR Maps
MDNR Report Data Sources: Tables and Figures